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Nudging health: Scarcity cues boost healthy consumption among fast rather than slow strategists (and abundance cues do the opposite)

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ABSTRACT

We examine the effectiveness of specific nudges in the choice environment to foster healthy choice and consumption among consumers with fast vs. slow life history strategies (LHS)—short-term, impulsive, reward-sensitive (fast) vs. long-term, reflective, controlled (slow) foci—associated with low and high socio-economic status (SES), respectively. The results of two experiments, conducted in a field and an online setting, show that consumers with a fast, rather than slow, life-history strategy are more susceptible to scarcity cues, boosting choice and actual consumption of healthy foods when these cues are associated with the healthy option. Conversely, for slow LHS consumers, the evidence suggests that scarcity cues are less influential, and instead abundance cues tend to foster healthy choice. Finally, in line with the LHS logic, acute food craving mediates the impact of scarcity vs. abundance cues for fast, but not slow, strategists, while perceptions of socially validated trust in the food source fulfill this role for slow, but not fast, strategists.

1. Introduction

How to curb the obesity epidemic? According to the World Health Organization (WHO, 2018), obesity rates have grown dramatically over the last few decades. Starting in Western, developed countries, the trend has seen spreading in less developed parts of the world in recent years as well. Moreover, rising obesity rates are no longer limited to adults, but extend to children of ever younger ages (e.g., Nobari, Whaley, Prelip, Crespi, & Wang, 2018; Skinner, Ravanbakht, & Skelton, 2018). These issues make obesity one of the more pressing public health challenges facing the globe (WHO, 2018). Indeed, obesity is associated with both health and financial costs (Dobbs et al., 2014; Finkelstein, Trogdon, Cohen, & Dietz, 2009; Malnick & Knobler, 2006; National Institutes of Health, 1998), and despite billions of dollars spent on research and intervention programs, success rates are typically modest and the epidemic appears to continue spreading (MacLean et al., 2015).

One of the most striking features of the obesity trend is that it hits some populations harder than others. Particularly lower socio-economic status (SES) groups that lack economic and material resources, have lower educational backgrounds, and work in jobs of lower occupational status, appear at risk (e.g., Darmon & Drewnowski, 2015; Swinburn et al., 2011). This is a particular disturbing aspect of the epidemic, given that these groups are already disadvantaged and challenged in many spheres of life (e.g., Callan, Ellard, Will Shead, & Hodgins, 2008; Dennison, 2016; Walker & Mann, 1987).

The present paper aims to propose and test a new approach of developing interventions that may be particularly effective among these disadvantaged groups. Answering the call for more theory-driven, integrative approaches to address the obesity epidemic (e.g., Pavela, Allison, & Cardel, 2019), we turn to a recently proposed, new theoretical lens, rooted in evolutionary psychology and biology – Life History Theory (LHT; Ellis, Figueredo, Brumbach, & Schlomer, 2009; Figueredo et al., 2006; Griskevicius et al., 2013; Maner, Dittmann, Meltzer, & McNulty, 2017). More specifically, in the present research, we propose and will test the prediction that scarcity cues, associated with healthy food options, – such as claims highlighting that the healthy food is in limited supply, is only available for a limited amount of time, or only available at limited venues – may be particularly effective among consumers whose psychological and behavioral constellations, based on LHT, are particularly prevalent among low SES groups.

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1.1. SES, life history strategies and health behavior

Life History Theory (LHT; Ellis et al., 2009; Figueredo et al., 2006; Griskevicius et al., 2013; Maner et al., 2017; Del Giudice & Belsky, 2011; Kaplan & Gangestad, 2005) provides a comprehensive and integrative framework that may aid in understanding the food choices of the socially and economically disadvantaged and suggests specific avenues to foster healthier choice and decision-making. In short, LHT stresses that early life conditions shape and calibrate people's adaptive psychological and behavioral coping processes to maximize their reproductive potential throughout the lifespan (Kaplan & Gangestad, 2005; Maner et al., 2017). More in particular, conditions of childhood harshness, unpredictability and resource scarcity –conditions that are particularly prevalent among low SES groups (cf. Caldwell & Sayer, 2019; Hamilton, Mittal, Shah, Thompson, & Griskevicius, 2019; Maner et al., 2017; see also Sheehy-Skeffington, 2020) – signal that the future is uncertain and thus yield what is termed a *fast life history strategy* (fast LHS). Coping with such adverse conditions during early childhood and adolescence affects judgment and decision making throughout the lifespan. More specifically, fast LHS consumers may be more prone to early reproduction and to adopt a short-term orientation, a tendency for risk-seeking and impulsive, approach-oriented, appetitive judgment and decision making, aimed at immediate gratification of acute needs and wants. On the other end of the continuum are *slow LHS* consumers. Their early childhood and adolescence has typically been characterized by the opposite pattern: a relatively stress-free, and predictable environment with abundant resources, signaling an affluent, certain and secure future – conditions more prevalent among high SES groups. A slow LHS typically manifests itself in later reproduction, a focus on long-term goals, and a tendency for risk aversive, more reflective, controlled judgment and decision making (Del Giudice, Gangestad, & Kaplan, 2016; Figueredo et al., 2006; Griskevicius, Tybur, Delton, & Robertson, 2011; Hill, Prokosch, DelPriore, Griskevicius, & Kramer, 2016; Hill, Rodeheffer, DelPriore, & Butterfield, 2013; Kaplan & Gangestad, 2005; Wang, Kruger, & Wilke, 2009).

Research examining the relationship between SES, LHS and health-related choice and decision making is still in its infancy (Caldwell & Sayer, 2019). Nevertheless, recently Maner et al. (2017) using both cross-sectional and longitudinal data showed that current SES and childhood SES correlate (modestly) with LHS, and that lower childhood SES and higher childhood unpredictability indeed associate with a faster life history strategy. This faster life history strategy, in turn, promoted dysregulated eating and obesity in adulthood. In line with these findings, Hill et al. (2016) observed that while slow LHS individuals regulated their food intake as a function of their energy needs, fast LHS individuals did not and continued to consume higher amounts of food even when their energy need was low (i.e., when they were satiated). Finally, Laran and Salerno (2013) found that making conditions of environmental harshness and unpredictability salient, makes people believe that resources will be scarce, which in turn drives them to consume more high caloric and filling foods (see also Kaiser, Smith, and Allison (2012)).

1.2. Fast LHS and scarcity cues

While Laran and Salerno (2013) did not actually measure participants' individual differences in LHS, this latter finding is interesting because it suggests that cues that signal scarcity may prompt food intake. Moreover, related studies have found that scarcity cues become more salient and signal a higher reward-value of food, particularly when food sources are deemed insecure or unpredictable (Anselme & Gunturkun, 2019; Cheung, Kroese, Fennis, & de Ridder, 2015; Crandall & Temple, 2018). These conditions fully dovetail with a fast LHS. Indeed, because consumers with a fast life history strategy have experienced conditions of resource scarcity, harshness and unpredictability from their early childhood onwards, it stands to reason to assume that they will be particularly sensitized and thus susceptible to scarcity cues in their food environment. Such cues may thus prompt fast LHS consumers to increase their food intake when they signal 'generic' unpredictability or resource scarcity (e.g., an economic downturn, unspecified conditions of scarcity, or increasing unemployment rates, see Laran & Salerno, 2013). However, this observation also opens the door to a new, and as yet untested intervention that may "nudge" (Thaler & Sunstein, 2008) healthier rather than energy-dense food consumption among these consumers (cf. Liem & Russell, 2019; Marchiori, Adriaanse, & De Ridder, 2017; Thaler & Sunstein, 2008). That is, if the scarcity cue is not generic but domain-specific and directly associated with a healthy food option (e.g., healthy foods advertised as "limited availability" or "while supplies last"), then we may expect that fast LHS consumers will be particularly sensitive to, and will respond more favorably towards, the food associated with the scarcity cue. Thus, associating scarcity with a healthy food option may nudge healthier food choice and consumption among these consumers. The present set of studies was designed to directly test this prediction.

1.3. Slow LHS, and cues to scarcity vs. abundance

But what about their slow LHS counterparts? There may be at least two alternatives. One ostensibly straightforward possibility is that the psychological constellation of slow LHS consumers simply renders them less susceptible to food-associated scarcity cues than fast LHS consumers. If so, then we would expect individual differences in LHS to moderate the impact of food-related scarcity cues on healthy consumption and choice, such that the impact would be more pronounced for fast than slow strategists (i.e., an ordinal interaction).

However, there is also a second possibility, which follows from several interlinked strands of reasoning. More specifically, we may extrapolate the reasoning underlying the perceptions of fast LHS consumers to their slow LHS counterparts: if scarcity cues indeed resonate with the typical environmental conditions of the former, then by extension it may well be that their opposite, cues to affluence and abundance, resonate more with the typical environmental conditions of the latter. Thus, compared to scarcity cues, we might – by the same token – observe the *opposite* impact of type of cue for their slow LHS counterparts. That is, given their experience with a childhood environment characterized by a high level of security, predictability and the abundant availability of resources, we may also observe slow LHS consumers to be particularly sensitive and responsive to cues signaling the *abundance* of healthy food items, rather than their scarcity. Note, however, that this reasoning does not provide a process explanation of *why* such an impact of type of cue – opposite to that of fast LHS consumers – might be observed.

However, such a process explanation *is* implied by work by Nisbett and Kunda (1985), Zajonc (1968), and particularly Kwan, Yap, and Chiu (2015), that suggests that people actively use cues about the relative prevalence and the social distribution of entities in their environment to infer the extent of social familiarity and the existence of a descriptive norm with regard to the entity. Frequently encountered, prevalent and abundant entities in a stable environment signal that many others are probably familiar with them and share a positive predisposition toward them, inferences that directly feed into perceptions of safety and trust (cf. Kwan et al., 2015). Interestingly, other work (Forss, Koski, & van Schaik, 2017) suggests that making such social validation inferences from prevalence cues tends to be more typical for slow as opposed to fast LHS individuals. Indeed, given their tendency for risk aversion, cues that signal familiarity and trust dovetail fully with the psychology of slow rather than fast LHS consumers. Hence, for slow, but not fast LHS consumers, cues to wide and stable availability may signal a predictable and secure food source, safely used by many fellow consumers, which may promote a socially validated sense of trust in the food source. Consequently, slow, rather than fast LHS consumers may evaluate food options more favorably when they

are plentiful, rather than in short supply.

When contrasting scarcity with abundance cues, this would similarly imply that individual differences in LHS will moderate the impact of food-related scarcity vs. abundance cues on healthy consumption and choice, but now such that the impact would *reverse* for slow, compared to fast LHS consumers. Thus, when associated with a healthy option, scarcity, rather than abundance, would promote healthier consumption and choice among fast consumers, while the opposite would hold for slow LHS consumers, implying a disordinal, crossover interaction.

Because the "state of the science" currently does not point to an unequivocal choice between both options, we refrain from formulating an a priori hypothesis on any specific interaction effects for slow LHS consumers, and we will explore and assess the empirical support for both in the present set of studies.

1.4. Mediating the impact of scarcity vs. abundance cues

What may drive any differential effects of scarcity vs. abundance cues for fast and slow LHS consumers? In keeping with their respective psychological "make-up", we examine two potential mediating constructs in the present research, that map onto the fast vs. slow LHS distinction. First, fast LHS consumers are thought to exhibit a tendency for "hot cognition", characterized by a need for short-term gratification, and a tendency for impulsive, appetitive and reward-sensitive judgment and decision-making (Del Giudice, 2014; Griskevicius et al., 2011; Hill et al., 2013, 2016). Hence, for fast (but now slow) LHS consumers, it makes sense to assume that any impact of scarcity cues on food-related decision making may be mediated by *acute craving* for the food item –an indicator of acute, impulsive and appetitive urgency (cf. Tiffany & Drobes, 1991).

Second, the decision-making of slow LHS consumers is thought to be more governed by "cold cognitions", longer-term goals and more reflective, risk averse and controlled consideration and judgment (Ellis et al., 2009; Griskevicius et al., 2013; Wang et al., 2009). We speculate (rather than propose) that abundance cues may resonate well with this mindset by suggesting wide and stable availability of the item, thus signaling a predictable, and secure food source safely used by many fellow consumers, and hence trustworthy. Thus, for slow (but not fast) LHS consumers, we may explore whether a sense of *socially validated trust* in the food source mediates any impact of abundance cues on food-related decision making.

Note that this reasoning implies two *distinct* processes underlying the impact of scarcity versus abundance cues: one for fast and one for slow LHS consumers. Therefore, we will include both mediating constructs *simultaneously* in our research to explore to what extent they drive any conditional effects of types of cue on food choice as a function of LHS.

1.5. The present research

We provide evidence for our ideas in two experiments, conducted both in the field as well as online, including both actual healthy food consumption (Experiment 1), as well as intentions to buy healthy food (Experiment 2), and using different tasks and measures across studies to assess the robustness of our findings.

Experiment 1 takes the main hypothesis to the field and aims to demonstrate that associating scarcity cues with a healthy food option may promote increased consumption among fast LHS consumers. This study uses the validated Mini-K questionnaire (Figueredo et al., 2006, 2014) to assess individual differences in LHS.

Experiment 2 replicates and extends Experiment 1 and moves from the field to an online experimental setting. It examines intentions to buy a healthy food item in addition to the overt behavior featured in Experiment 1. Moreover, in Experiment 2, we employed a more controlled (checked) manipulation of scarcity versus abundance cues, and we checked the stability of any results, controlling for participants' hunger level, pre-existing preference for the healthy food and any allergy for the food. Furthermore, in line with Maner et al. (2017), this study aims to assess the robustness of our findings by using an alternative measure of LHS – childhood unpredictability (cf. Griskevicius, 2017; Maner et al., 2017; Mittal, Griskevicius, Simpson, Sung, & Young, 2015; Young, Griskevicius, Simpson, Waters, & Mittal, 2018). We also assess whether this LHS measure actually associates with participants' current SES and with participants' BMI as other work (Maner et al., 2017) and our reasoning implies. Finally, we explore the underlying drivers (mediators) of any differential effects found of scarcity vs. abundance cues on healthy food choice for fast vs. slow LHS consumers.

2. Experiment 1

Experiment 1 was conducted in a field setting and aimed to provide a first test of the hypothesis that actively associating a scarcity cue with a healthy food would boost consumption, particularly among consumers with a fast, rather than slow life history strategy. This study featured actual consumption of a healthy food item (green grapes) as its main dependent variable.

2.1. Method

2.1.1. Design and participants

This study used a single factor (scarcity cues vs. control) between-subjects design with individual differences in LHS as a measured independent variable. A total of 100 consumers were randomly approached at a campus of a large Dutch university and were asked to voluntarily participate in the study that aimed to assess their personality and consumption choices. After removing 5 observations for failing an attention check (see next), the final sample for this study consisted of 95 participants, with a mean age of 23.20 years (SD = 7.61, 41% female).

2.1.2. Procedure and measures

Participants were informed that they would be completing a number of questions as part of a larger project, while being allowed to consume a food product. Next, all participants were presented with a small transparent, plastic box containing 10 green grapes. Participants were randomly assigned to conditions. In the scarcity cue condition, the product label included the statement "limited availability" and participants were informed that the grapes came from a specific region in Chile, were difficult to grow and thus limited in supply. Hence the grapes were only available in specialty shops during two months of the year. In the control condition, neither the product description nor the label contained any reference to limited availability, and the grapes, instead, were presented as easy to grow and widely available in supermarkets throughout the year.

Next, all participants were asked to taste these grapes and were told to eat as many or as few as they wished. The number of grapes consumed (range 0–10, M = 4.60, SD = 4.57) constituted the key dependent variable in this study. After this task, participants answered a questionnaire to assess individual differences in LHS. We used the validated Mini-K questionnaire (Figueredo et al., 2006, 2014; Richardson, Chen, Dai, Brubaker, & Nedelec, 2017) which assesses individual differences in LHS on a single fast-to-slow continuum using twenty, 7-point Likert items (1 = disagree strongly, 7 = agree strongly). Sample items include, "*I try to understand how I got into a situation to figure out how to handle it*" and "*I avoid taking risks*" (see Figueredo et al. (2006) for a full listing of the items). We averaged the Mini-K scores (range 3.75–6.35, M = 5.30, SD = 0.59) to arrive at an overall LHS score with lower scores indicating a faster LHS (Cronbach's alpha = 0.75). Finally, participants indicated their age, and answered an attention check item ("*Please encircle the option 'very true (4)' below*", cf. Oppenheimer, Meyvis, & Davidenko, 2009).

2.2. Results and discussion

2.2.1. Randomization checks

A series of randomization checks on gender, age, and our LHS measure revealed no association between the conditions of our manipulated independent variable (type of cues) and the distribution of participants across cells in terms of gender ($\chi^2 < 1$), age (F (1, 93) = 1.62, p = .21, *n.s.*), and LHS ($F < 1$). Thus, random assignment to conditions was successful.

2.2.2. Target analysis

Due to the continuous nature of the proposed moderator (LHS), we conducted a multiple regression analysis, using the SPSS PROCESS macro (Model 1, Hayes, 2018) to analyze the data (using dummies and centered scores for predictors, cf. Aiken & West, 1991; Hayes, 2018). For this analysis, we regressed consumption rate on type of cue (scarcity vs. control), LHS, and its interaction. We report the results of two sets of analyses: first including all participants, followed by an analysis on a trimmed sample, including only those participants who actually consumed any to all of the grapes (58% of the full sample).

First, using the full sample, while the main effect of LHS was non-significant ($B = -0.37$, $SE = 0.68$, $t < 1.$), exposure to scarcity cues significantly increased actual consumption of grapes compared to the control condition ($B = 4.78$, $SE = 0.79$, $t(91) = 6.05$, $p = .0001$). Importantly, the interaction between type of cue (scarcity vs. control) and LHS proved to be significant and qualified the main effect ($B = -3.28$, $SE = 1.36$, $t(91) = -2.41$, $p = .02$, $r = 0.21$). Additional simple slopes analyses to probe the interaction (cf. Spiller, Fitzsimons, Lynch, & McClelland, 2013) showed that the impact of scarcity cues on actual consumption of a healthy food was more pronounced for fast LHS consumers (evaluated at – 1 *SD* from the mean, $B = 6.70$, $SE = 1.12$, $t(91) = 5.96$, $p = .0001$), than slow LHS consumers, although the impact remained significant ($B = 2.86$, $SE = 1.12$, $t(91) = 2.55$, $p = .01$, evaluated at +1 *SD* from the mean). Yet, the effect proved to be 2.34 as large for fast, compared to slow LHS consumers (see Fig. 1).

In addition, when focusing only on those consumers that actually consumed one or more grapes, the interaction between LHS and type of product cue remained (marginally) significant ($B = -2.98$, $SE = 1.52$, $t(51) = -1.95$, $p = .056$, $r = 0.26$), indicating that the previous interaction was not driven by the relatively high proportion of participants who did not consume any grapes. More importantly, an additional simple slopes analysis to probe the interaction paralleled the previous one, and showed even more prolifically, and consistent with our theorizing, that the impact of scarcity cues on grape consumption was more pronounced for fast than slow LHS strategists. Indeed, while the impact retained its significance for fast LHS participants ($B = 3.51$, $SE = 1.28$, $t(51) = 2.74$ $p = .008$, evaluated at $M - 1$ SD), it shrunk to non-significance for their slow LHS counterparts ($B = 0.07$, $SE = 1.20$, $t < 1$, evaluated at $M + 1$ SD, see Fig. 2). When zooming in on

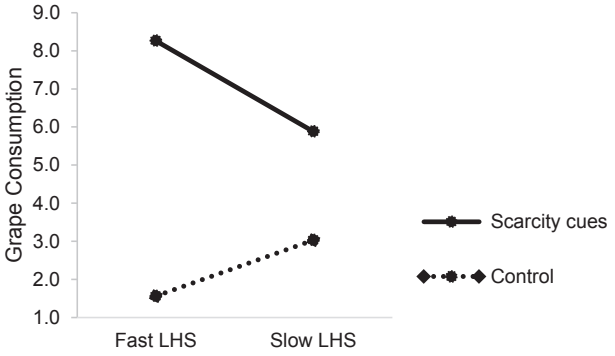

Fig. 1. Effects of scarcity cues vs. control and LHS on grape consumption (full sample, Experiment 1).

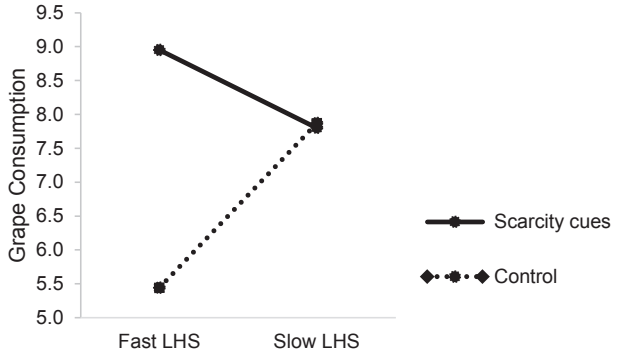

Fig. 2. Effects of scarcity cues vs. control and LHS on grape consumption (trimmed sample, Experiment 1).

participants at the more extreme slow end of the fast-to-slow continuum (starting at values > +1.16 *SD* from the mean), coefficients started to change from positive to *negative* (although remaining non-significant, *p's* > 0.46, *n.s.*), suggesting that scarcity cues tend to *reduce* consumption among these consumers.

Hence, the present study showed that appeals to scarcity may be particularly suitable to nudge fast LHS participants to actually consume healthy foods. As such, using scarcity cues appears to resonate well with the particular psychological "make-up" that is implied by the fast life history strategy. That is, the scarcity and unpredictability that they likely faced during early childhood and adolescence may have predisposed these consumers to be particularly attentive to scarcity cues, and respond with a more pronounced approach tendency toward them, compared to slow LHS participants. The outcome of this approach behavior is healthier consumption, and as such, the present study is the first to show the health promotion potential of using these kinds of nudges to foster healthy eating among a typically challenged and disadvantaged group when it comes to health and wellbeing.

With regard to the observed intake of grapes, participants were not required but free to taste one or more of the grapes, and stop whenever they wished, which may explain the mean intake and the proportion of participants that consumed any or all of the grapes. Interestingly, the analysis on this latter, trimmed sample that consumed any to all of the grapes, indicated that scarcity cues were not only ineffective for slow LHS consumers, but that for those consumers at the more extreme slow end of the fast-to-slow continuum, the sign of the (non-significant) effect of scarcity cues on healthy eating tended to change from positive to negative. This suggests that these consumers are not only less sensitive to scarcity cues, but possibly respond more favorably to its opposite – cues that signal abundance of certain food items. Unfortunately, the inherently 'noisy nature' and limitations of a field study, e.g., the modest sample size, the absence of a manipulation check, and the fact that the control condition was not unequivocal in stressing the abundance of the grapes (e.g., the absence of an abundance suggesting cue on the product label, for example) precludes any strong statements on this point. Thus, this interesting possibility is explored in more detail in the next study. Moreover, in Experiment 2, we extend the present findings by focusing on an alternative dependent variable – intentions to buy a healthy option. The immediate, acute, overt food intake in the present study may be an outcome that is likely more in line with a fast than a slow strategy, thus possibly obscuring any effects on judgment and choice for the latter. Conversely, behavioral intentions may be viewed as goals, referring to desired future choices, rather than acute behavior in the here and now, an aspect that may particularly resonate with, and thus potentially better able to 'pick up' effects for, slow LHS consumers. In addition, the present study did not report a correlation between participants' current SES, BMI, and their LHS (cf. Maner et al., 2017), something that the next study will "remedy" as well. Finally, we will assess whether any effects are robust when controlling for

participants' current SES to assess the predictive relevance of the LHS construct over and above current SES.

3. Experiment 2

This experiment aimed to achieve several objectives. First, we aimed to find converging evidence for our ideas, and sought to replicate the main finding of Experiment 1, demonstrating that scarcity cues associated with a healthy option are particularly effective among fast LHS consumers, promoting healthier choice among these consumers. In addition, the present study aimed to more explicitly explore the possibility that the opposite may hold for slow LHS consumers, rendering them more susceptible to cues of abundance and unlimited availability. The present study includes a more unequivocal (and checked) manipulation of such cues to abundance and unlimited availability to test this possibility.

In addition, we explore what may drive any differential impact of scarcity vs. abundance cues on healthy choice intentions for fast vs. slow LHS consumers. To this end, we include two potential mediating constructs in the design of the present study, which align with the respective psychological "make-up" of fast and slow LHS consumers – *acute craving* and *socially validated trust* in the food source. We assess whether acute craving will mediate the impact of scarcity vs. abundance cues on food choice for fast, but not slow LHS participants. Conversely, we (simultaneously) test whether perceptions of socially validated trust mediate the impact of such cues for slow, but not fast LHS participants.

3.1. Method

3.1.1. Design and participants

In the present study, we moved from the field to an online experimental setting and used a substantially larger sample in order to have sufficient power to detect the effects of interest and so rule out that the previous findings were a 'false positive'. Using the observed effect size of the critical interaction between scarcity cues and LHS found in the previous study as input ($r = 0.21$), and aiming at 80% power (using $\alpha = 0.05$), a power analysis using *G*Power* (Faul, Erdfelder, Buchner, & Lang, 2009), indicated we would need a sample size of at least $N = 199$ to observe the critical interaction.

In the present study, we exceeded this minimum and recruited a total of 233 participants using the Prolific Academic online participants' pool, who participated in exchange for a small monetary payment ($M_{age} = 30.10$, $SD_{age} = 9.43$, 58.8% females). While Experiment 1 overwhelmingly (though not exclusively) included students of the university and university of applied sciences which share the same campus, the present sample consists of a more heterogeneous sample of "actual" consumers from various backgrounds, education and income levels, and nationalities (mostly UK citizens, but also participants from the US, Canada, Spain, Italy, Mexico, Poland, and a range of other countries worldwide). Similar to the previous experiment, the present study employed a single factor (scarcity cues vs. abundance cues) between-subjects design with individual differences in LHS as a measured independent predictor. The main dependent variable was the intention to buy a healthy food item (dried cranberries).

3.1.2. Procedure and measures

As a part of a larger study, participants were told that the study consisted of several unrelated parts. The first part involved evaluating a particular food product. Participants were randomly assigned to conditions and presented with one of two product descriptions and were instructed to read the description carefully and take their time to think about the product. More specifically, participants were exposed to an ad for a fictitious brand of dried cranberries "Original Nordic®" containing a more detailed description of the product, which either featured scarcity cues or abundance cues (see Appendix A for stimulus materials). More specifically, in the scarcity cue condition, participants learned that the cranberries represented a rare species that only grows in a very specific area, which can be harvested only during a limited time and thus is only available in specialty stores during a limited time of the year. The header in this condition read "Limited availability". In the abundance condition, the following header was used: "Always there for you", and the ad conveyed that the cranberries were of a common species that grows in large areas, can be harvested anytime, and are thus widely available without any restrictions. Next, to strengthen the manipulation, after reading the description, participants were asked to write down their thoughts and feelings about the product in 4–6 sentences in as much detail as possible.

After exposure to the ad, participants indicated their intention to buy the food product on a three-item 7-point Likert scale (Putrevu & Lord, 1994): *I will purchase this brand the next time I need such a product, I will definitely buy this brand,* and *It is very likely that I will buy this brand* (1 = totally disagree, 7 = totally agree). We created an intention to buy-index by averaging the scores on the items with higher scores indicating higher buying intentions ($M = 4.12$, $SD = 1.74$, Cronbach's $\alpha = 0.93$).

Participants also rated their acute craving for "Original Nordic®" dried cranberries on a five-item 5-point Likert scale (adapted from Tiffany & Drobes, 1991). Example items include: *I have a desire for Original Nordic® dried cranberries right now* and *Nothing would be better than Original Nordic® dried cranberries right now* (1 = totally disagree, 5 = totally agree, $M = 2.58$, $SD = 1.11$, Cronbach's $\alpha = 0.93$). In addition, based on Chaudhuri and Holbrook's (2001) brand trust scale, we measured socially-validated trust in this particular food item using four 7-point Likert statements: *I trust this brand, I want to ask questions about this brand, Nothing will make me try this brand (reversed),* and *If someone would give me this brand, I would be willing to try it.* An exploratory factor analysis on the measure yielded a one factor solution, explaining 47% of the observed variance, thus suggesting a unidimensional construct. A measure of socially validated trust was created by averaging the scores on the items, with higher scores indicating higher trust ($M = 4.79$, $SD = 0.90$, Cronbach's $\alpha = 0.65$).

Then, they completed an alternative measure of LHS. This measure is designed to directly tap into a critical driver of the fast vs. slow LHS distinction – childhood unpredictability (cf. Griskevicius, 2017; Mittal et al., 2015; Young et al., 2018). Importantly, while the Mini-K used in Experiment 1 describes the behavioral manifestations associated with the fast-to-slow continuum, the childhood unpredictability measure assesses its origins. Combined, the two yield the potential to test the robustness of our predictions across studies. We used the ten-item 9-point Likert scales instrument as developed by Griskevicius (2017), Mittal et al. (2015) and Young et al. (2018). Example items include: *My family life was generally inconsistent and unpredictable from day to day* and *Things were often chaotic in my house* (1 = definitely disagree, 9 = definitely agree). We averaged the childhood unpredictability scores to create an overall LHS index with higher scores indicating a faster LHS ($M = 3.63$, $SD = 1.96$; Cronbach's $\alpha = 0.91$).

To check the success of our manipulation of scarcity versus abundance cues, we asked participants to evaluate "Original Nordic®" dried cranberries on three-7-point Likert scales rating the extent to which they deemed the cranberries to be *scarce*, *rare,* and *widely available*. Furthermore, participants rated the advertised brand in terms of its appeal, attractiveness and perceived quality using 7 point Likert scales. Moreover, they completed demographic questions, including income (using an 8-point scale ranging from < £5000 (1) to > £40,000 (8), $M = 5.06$ (£20.001–£25,000), mode = < £5000, $SD = 2{,}92$), education level (using a 7-point scale, ranging from post graduate degree or equivalent (7) to none (1), $M = 2.87$, mode = 2 (undergraduate degree or equivalent), $SD = 1.85$), gender and age, as well as questions on their height and weight to assess their body mass index (BMI). We also checked participants' acute hunger level, their preference for dried cranberries, and whether they were allergic to dried cranberries.

3.2. Results and discussion

3.2.1. Randomization checks

We performed a series of randomization checks on gender, age, and our LHS measure showing no association between the conditions of our manipulated independent variable (type of cues) and the distribution of participants across cells in terms of gender ($\chi^2 < 1$), age (F (1, 132) = 1.57, p = .21, *n.s.*), and LHS ($F < 1$). Thus, random assignment to conditions was successful.

3.2.2. Manipulation checks

As expected, participants in the scarcity condition rated "Original Nordic®" cranberries more as a scarce product (M = 6.96, SD = 1.79; F (1, 231) = 264.26, $p < .001$) and rare product (M = 7.53, SD = 1.54; F(1, 231) = 355.79, $p < .001$) than participants in the abundance condition did (M = 2.82, SD = 2.08, and M = 2.90, SD = 2.16, respectively). Conversely, participants in the abundance condition rated the cranberries as significantly more widely available (M = 7.01, SD = 2.17) than participants in the scarcity cue condition (M = 3.01, SD = 2.24; F(1, 231) = 191.21, $p < .001$). Additional regression analyses showed that neither the type of cue, LHS, nor their interaction affected the attractiveness, appeal, or perceived quality of the advertised brand (all p's > 0.25, *n.s.*). Thus, the manipulation of scarcity versus abundance cues was successful.

3.2.3. Target analysis

In support of the ecological and construct validity of LHS (cf. Maner et al., 2017), we observed that our LHS measure correlated significantly, although modestly, with participants' current SES: we observed a negative correlation with their present education ($r = -0.19$, p = .004) and income level ($r = -0.17$, p = .009), suggesting that participants with a faster LHS tend to have a lower SES indicated by lower education and income levels than their slow LHS counterparts. Moreover, our LHS measure correlated significantly and positively with participants' BMI (r = 0.18, p = .005). Thus, replicating previous research (Maner et al., 2017), higher scores on the childhood unpredictability measure, indicating a faster LHS, associate with a higher BMI.

Next, to test our ideas, we conducted a multiple regression analysis, using the PROCESS SPSS macro given the continuous nature of the moderator (Model 1, using dummies and centered scores for predictors, cf. Aiken & West, 1991; Hayes, 2018). In this analysis we regressed intentions to buy the healthy food on type of cues (scarcity vs. abundance), LHS, and their interaction.

We observed that the main effect of type of cues (scarcity vs. abundance) on the intention to buy the healthy food item was not significant (B = 0.06, SE = 0.22, $t < 1$), nor was the main effect of LHS (B = 0.06, SE = 0.06, $t < 1$). However, the interaction between type of appeal and LHS was highly significant (B = -0.37, SE = 0.11, t (2 2 9) = -3.26, p = .001, r = 0.21). Importantly, this interaction remained significant when controlling for participants' hunger level, preference for the product and whether they were allergic to dried cranberries ($B = -0.28$, SE = 0.10, t(2 2 6) = −2.75, p = .007), thus underscoring the robustness of the results. Moreover, when controlling for participants' current SES (education and income level), the interaction remained unchanged ($B = -0.38$, SE = 0.12, t(2 2 7) = −3.34, p = .001), indicating that current SES and LHS, although related, are not identical and hence, not substitutable. Rather, these results demonstrate that the LHS construct possesses predictive validity *over and above* current SES.

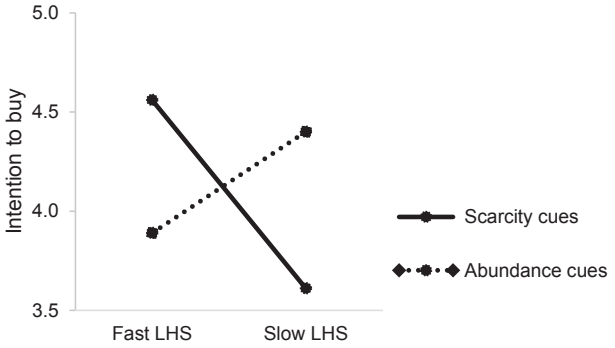

Fig. 3. Effects of scarcity vs. abundance cues and LHS on intentions to buy (Experiment 2).

Additional simple slopes analyses to probe the interaction (cf. Spiller et al., 2013) confirmed that the interaction was of a disordinal, crossover type. Replicating the previous results, for fast strategists (evaluated at +1 SD from the mean), scarcity cues elicited greater intentions to buy the healthy food product than abundance cues ($B = -0.67$, SE = 0.32, t(2 2 9) = −2.11, p = .04). In contrast, for slow strategists (evaluated at −1 SD from the mean), the reverse pattern emerged – abundance cues elicited greater buying intentions than scarcity cues (B = 0.79, SE = 0.32, t(2 2 9) = 2.49, p = .01, see Fig. 3).[1]

Thus, in line with our reasoning, we found that fast strategists compared to slow strategists respond more favorably to scarcity than abundance cues in the context of healthy food consumption, whereas slow strategists demonstrate the opposite tendency and respond more favorably to abundance than scarcity cues.

3.2.4. Moderated mediation analysis

Next, to explore what may drive these effects, we performed a moderated mediation analysis using PROCESS Model 7 (Hayes, 2018). For this analysis, we included both acute craving and socially validated trust in the food source as simultaneous, parallel, mediators of the differential impact of scarcity vs. abundance cues on intentions to buy for fast and slow LHS consumers. Using 5000 bootstrapped samples, the analysis first tests the impact of the independent variable (scarcity/abundance), the moderator (LHS) and its interaction on the proposed mediators (food craving and socially validated trust, paths *a*; cf. Baron & Kenny, 1986; Hayes, 2018; Muller, Judd, & Yzerbyt, 2005; Yzerbyt, Muller, Batailler, & Judd, 2018).

On the first proposed mediator, *food craving*, the main effects of scarcity/abundance ($B = -0.25$, SE = 0.14, t(2 2 9) = −1.74, p = .08, *n.s.*) and of LHS (B = 0.05, SE = 0.04, t(2 2 9) = 1,25, p = .21, *n.s.*) were not significant. However, the interaction effect between scarcity/abundance and LHS proved to be significant ($B = -0.16$, SE = 0.07, t(2 2 9) = −2.24, p = .03). In line with the idea that fast, but not slow, LHS consumers are driven by acute, impulsive, judgment and decision making, additional simple slopes analyses showed that only for fast LHS consumers, scarcity cues elicited more acute craving than abundance cues ($B = -0.57$, SE = 0.20, t (2 2 9) = −2.81, p = .005). Indeed, for their slow LHS counterparts type of cues did not affect acute food craving (B = 0.07, SE = 0.20, $t < 1$).

On the second mediator, *socially validated trust* in the food source, the results reversed. That is, the main effects of scarcity/abundance (B = 0.08, SE = 0.12, $t < 1$) and LHS ($B = -0.04$, SE = 0.03, $t < 1$) again did not reach significance. However, the interaction effect between scarcity/abundance and LHS proved to be significant and the

[1] Reverse simple slopes analyses further corroborated these results and showed that the impact of LHS was *positive* for scarcity cues (B =0.24, SE = 0.08, t(2 2 9) = 2.99, p =.003)—indicating that for scarcity cues, faster LHS predicted more positive (and slower LHS more negative) intentions to buy—but (marginally) *negative* for abundance cues (B = -0.13, SE = 0.08, t(2 2 9) = −1.61, p =.10)—indicating that for abundance cues, faster LHS predicted more negative (and slower LHS predicted more positive) intentions to buy.

pattern was opposite ($B = -0.14$, $SE = 0.06$, $t(2\ 2\ 9) = -2.29$, $p = .02$). In line with our reasoning that slow, but not fast, LHS consumers are driven by more controlled, reflective and risk averse judgment and decision making, additional simple slopes analyses showed that abundance cues elicited a higher sense of trust than scarcity cues among slow LHS consumers ($B = 0.35$, $SE = 0.17$, $t(2\ 2\ 9) = 2.12$, $p = .03$). In contrast, for their fast LHS counterparts type of cues did not affect perceptions of trust ($B = -0.19$, $SE = 0.16$, $t(2\ 2\ 9) = -1.12$, $p = .26$, *n.s.*).

As a second step, the moderated mediation analysis tests whether and to what extent the two mediators entered simultaneously affect the outcome, intentions to buy the healthy item (paths *b*), while controlling for the effect of the independent variable (type of cues) on the outcome (path *c'*). The results of this step indicated that both mediators in parallel significantly affected buying intentions ($B_{craving} = 0.88$, $SE_{craving} = 0.08$, $t(2\ 2\ 9) = 10.75$, $p = .001$; $B_{trust} = 0.57$, $SE_{trust} = 0.10$, $t(2\ 2\ 9) = 5.64$, $p = .001$) while the effect of type of cue shrunk to non-significance ($B = 0.23$, $SE = 0.15$, $t(2\ 2\ 9) = 1.57$, $p = .12$, *n.s.*). These results indicate full conditional mediation of the effect of scarcity vs. abundance cues on intentions to buy the healthy option by both mediators in parallel (cf. Baron & Kenny, 1986; Muller et al., 2005; Hayes, 2018).

As a final step, to flesh out the conditional indirect effect for fast vs. slow LHS consumers for each mediator, the analyses showed that the indirect effect of scarcity vs. abundance on buying intentions via *food craving* was significant for *fast* LHS consumers, for whom the 95% CI surrounding the indirect effect excluded zero ($B = -0.51$, $SE = 0.21$, 95% CI: [−0.94, −0.12]), but not for their slow LHS counterparts ($B = 0.06$, $SE = 0.17$, 95% CI: [−0.27, 0.41]). Conversely, for the second mediator, the pattern reversed and the indirect effect of abundance vs. scarcity cues on intentions to buy the healthy food item via *socially validated trust* was significant for *slow* LHS consumers ($B = 0.20$, $SE = 0.10$, 95% CI: [0.03, 0.41]), but not for fast LHS consumers ($B = -0.11$, $SE = 0.12$, 95% CI: [−0.37, 0.12]).

In sum, the present study replicated the basic pattern found in the previous study under more controlled, powerful conditions. Fast LHS consumers respond more favorably to scarcity cues, compared to abundance cues and show improved intentions to buy a healthy food option. Interestingly, bringing the trace of evidence of Experiment 1 more to the fore, the present study also showed that the opposite effect of type of cue holds for slow LHS consumers. Matching their fundamental psychological 'make-up', these consumers tend to be more attuned and respond more favorably to cues signaling abundance rather than scarcity, translating into more positive buying intentions for these consumers. In addition, the results of the moderated mediation analysis support the view that the impact on judgment and decision making is driven by more impulsive, appetitive processes for fast, but not slow LHS consumers (i.e., via food craving), and more risk aversive, reflective processes (socially validated trust) for slow, but not fast LHS consumers.

4. General discussion

The present paper explored the potential of Life History Theory (Kaplan & Gangestad, 2005) to curb the obesity epidemic (World Health Organization, 2018). Following this framework, we examined how and when consumer life history strategies (LHS) – short-term, impulsive, reward-sensitive (fast) vs. long-term, reflective, controlled (slow) foci-associated with low and high SES, respectively – might boost the effectiveness of scarcity vs. abundance nudges in the choice environment to foster healthy choice and consumption, as alternatives to energy-dense foods which may accelerate the obesity problem. We found in two studies that scarcity cues, associated with healthy food options were particularly effective to boost healthy consumption and choice among fast, rather than slow LHS consumers, thus "nudging health" among these consumers. In contrast, in Experiment 2 in particular, we observed that cues signaling abundance of a healthy food option were more effective for slow, rather than fast LHS consumers. Moreover, a series of conditional process analyses in Experiment 2 sheds light on the (moderated) processes underlying the effects found. That is, fully in line with the specific psychological constellation that make up both ends of the LHS continuum – an acute, reward-sensitive impulsive (fast), vs. a more long-term, risk-averse and controlled (slow) orientation – we found that acute food craving mediated the effects of scarcity vs. abundance cues for fast, but not slow LHS consumers Conversely, socially validated trust in the food source mediated the effect of type of cue for slow, but not fast LHS consumers. Considered jointly, both mediating processes in parallel accounted for the impact of such cues for fast vs. slow LHS consumers.

To warrant the robustness of the results, we gathered evidence both in a field and an online setting, using a total of 328 participants, both students and "real" consumers, assessing actual food intake as well as behavioral intentions to buy for two types of healthy food items (green grapes and dried cranberries), including several control variables, and alternating tasks and measures across studies. These design and control measures have effectively ruled out that the present findings were a 'false positive' or the result of any specific design or measurement issue.

In so doing, the results – showing the differential effects of scarcity vs. abundance cues on healthy choice and consumption – underscore the applied relevance of using Life History Theory (Kaplan & Gangestad, 2005) as a health promotion framework. Furthermore, the associations of LHS with current SES and BMI, as well as the conditional process analyses, also highlight the construct validity of the fast-to-slow LHS continuum, as well as the theory from which it is drawn. Interestingly, the effect size of the critical interaction between LHS and type of cue was of similar magnitude across the two studies, despite the differences in set up and sample composition, underscoring the robustness of the effects and arguing against a selection bias. In addition, while perhaps modest, our observed effect sizes are what Funder and Ozer (2019) label "medium" effect sizes (or "typical" according to Gignac and Szodorai, 2016) indicating explanatory and practical relevance, also in the short run, according to these authors. This also underscores the value of accounting for participants' LHS when developing efforts to promote healthier choice and decision making among low SES groups. Please note, however, that our results do *not* imply that LHS equates with current SES. It does not. Rather, in line with theory and previous results (Maner et al., 2017), we find a significant, though modest, correlation between LHS and current SES. Thus, the two constructs are not identical and hence, not substitutable. Indeed, we found that the interaction between LHS and type of cue on intentions to buy the healthy food item remains significant when controlling for participants' current SES. This shows the predictive potential of LHS *over and above* current SES. Hence, rather than a SES substitute, LHS has a distinctive and incremental role to play in predicting responses to health-related scarcity (vs. abundance) appeals.

Theoretically, this actually makes good sense: the LHS framework and Life History Theory from which it is drawn, highlight the role of *childhood* conditions of scarcity and unpredictability vs. affluence and stability, rather than one's present conditions. This implies that the present approach to use the LHS framework for the development of health-related interventions, may be most informative and useful for those consumer segments for which one can assume *low* socio-economic mobility. After all, for these segments, one may assume that consumers' childhood conditions may correlate highly with their current conditions, and consequently, that any ensuing implications based on their life history strategies may map well onto their current SES status. In contrast, for those consumer segments where upward (and/or downward) mobility in terms of SES is more prevalent, the association between LHS and current SES will – by necessity – be smaller. Hence, researchers would be advised to systematically measure both childhood and current SES conditions and associate them with participants' LHS to determine the (lack of) convergence between SES and LHS. Thus, we

summarily argue that LHS is a worthwhile and promising construct to take into account *in addition to* SES in order to develop effective interventions to foster health and well-being among at-risk consumer segments.

Together, our findings attest to the value of using a more theory-driven approach, rooted in evolutionary psychology and biology (cf. De Graaf, 2006; Maner et al., 2017), to help fight the obesity epidemic. Interestingly, it does so, not by urging consumers differing on the fast-to-slow LHS continuum to reduce their calorie intake, nor to expect them to undergo an effortful training program or to fundamentally change their lifestyles (the success of which is typically limited, see Fennis, Andreassen, and Lervik-Olsen (2015)), but instead to use simple and efficient 'nudges' associated with healthier (natural, less energy-dense) food alternatives, embedded in the choice environment that directly tie in to their psychological constellation. As such, this approach is exploiting the 'value from fit' principle between type of cue or appeal and psychological 'make up' as it has been demonstrated in other spheres of communication and persuasion as well (Fransen, Fennis, Pruyn, & Vohs, 2011). Other cues that are compatible with the LHS framework that may be considered may for example include associating healthy foods with cues signaling social support from family or friends (cf. Maner et al., 2017; Figueredo et al., 2006). Nevertheless, as highlighted above, while the current results suggest that the present approach yields a significant and relevant contribution in fighting the obesity epidemic among low SES groups, over and above approaches that directly target current SES *per se* (as we also demonstrate empirically in Experiment 2), we would like to caution against inferring that the present approach would constitute the ultimate solution to the problem. It is not, but it likely *will* play a substantial and relevant role in conjunction with a host of additional interventions that have been developed to address the issue.

Interestingly, our use of scarcity cues also highlights that the present approach essentially makes use of the same tools and techniques that marketers frequently use to seduce consumers to consume more energy-dense and sugary foods (e.g., "limited edition" hamburger menus, or "now or never" soft drink deals). However, we use them to *fight* the obesity problem, rather than to accelerate it. Of course, this latter point also signals the "dark side" of the approach developed in the present work. Scarcity cues will likely exert their respective effects regardless of the actual type of food or product with which it is associated, and so may well backfire and may trigger more *un*healthy consumption among fast LHS consumers when associated with calorie-rich and sugary foods. Thus, the present results may also be informative and helpful for policy makers regulating claims on food packaging and advertising. The ubiquitous presence of scarcity cues on packages and advertising for sugary and high caloric foods may well be one of the drivers accelerating the obesity problem among fast LHS consumers, and hence actively restricting such claims for these foods may be part of the solution. Finally, perhaps to the extent that scarcity cues trigger a "calorie-seeking mindset" (as per Laran and Salerno (2013)), even associating such cues with a healthy option may possibly spillover to also affect more indulgent, unhealthy choice behavior among fast LHS consumers, unless such options are absent from the choice environment. This constitutes an interesting implication to further explore.

4.1. Future research directions

The present research underscores the value of using scarcity cues to promote healthier consumption among traditionally challenged and disadvantaged individuals – fast LHS consumers that have experienced conditions of harshness, unpredictability and resource scarcity, signaling an uncertain future. The actual cues used in our studies refer to what Van Herpen, Pieters, and Zeelenberg (2014) have labeled *supply scarcity* – limited availability of resources due to accidentally or intentionally limiting the supply of the resource to the market. In contrast, *demand scarcity* comprises the limited availability of resources due to popular demand (Van Herpen et al., 2014). Future research may fruitfully examine whether this latter type of scarcity can elicit similar effects for fast vs. slow LHS consumers.

Our results qualify two assertions from the literature that may be less universal than generally conceived: (1) that scarcity cues have a motivational effect, and (2) that nudges are more influential under conditions conducive to "hot cognition" and impulsivity. More specifically, the first assertion is qualified by our finding that the motivational impact of scarcity may not be universal, but is modulated by individual differences in LHS. The second assertion is qualified by our finding that nudging may also be effective under conditions *less* conducive to "hot cognition" and impulsivity, since we observed an effect for abundance nudges under conditions more conducive to "cold cognition" and more reflective responding (i.e., for slow LHS consumers). While the present studies did not include measures on the depth of information processing *per se*, the observation that abundance cues triggered more extensive inferences on familiarity and socially validated trust among these consumers arguably attests to a less impulsive, more controlled and reflective process underlying the impact of abundance cues, something future research may test in more detail.

Interestingly, the present findings converge with the role of low (chronic and state) self-control in the impact of scarcity on food choice (Cheung et al., 2015; Watts, Duncan, & Quan, 2018). This is not surprising since planning and control is one of the facets included in the spectrum of dimensions that comprises the fast-to-slow continuum (Figueredo et al., 2006). Yet, given that LHS is a richer construct, it remains to be investigated whether other 'nudges' or heuristics (Cialdini, 2009) that have been found to be particularly effective under low self-control conditions (see Fennis, Janssen, and Vohs (2009) and Fennis (2017) for an overview), are equally effective for fast LHS consumers. That is, while the effects of scarcity converge, the impact of for instance the heuristics of *reciprocity* or *commitment and consistency* (Cialdini, 2009; Fennis et al., 2009) may well *diverge* from what has been found in self-control research (Fennis, 2017). That is, while both heuristics have been found to be more effective under low self-control conditions, the short-term, reward sensitive and sometimes opportunistic orientation associated with a fast LHS (Figueredo et al., 2006; Nettle et al., 2019) may well *limit,* rather than boost their impact among these consumers, something that future research may want to examine.

Finally, the practical constrains imposed on us when conducting the field study reported here forced us to use an efficient, validated, but also highly condensed measure to assess individual differences on the fast-to-slow LHS continuum – the 20 item Mini-K (Figueredo et al., 2006). This precluded any detailed additional analyses delving deeper into the (rich) dimensional structure of the LHS continuum. Thus, future research may want to build on the present findings by using the full measurement instrument from which the Mini-K is derived – the 199 item Arizona Life History Battery (Figueredo et al., 2014; Figueredo, 2007). Doing so might enable researchers to pinpoint whether the present effects are attributable to an overall factor (as the theory would imply, see Figueredo et al. (2006) and Richardson et al. (2017)), or whether specific facets within the construct drive the effects.

4.2. Concluding remarks

Concluding, exploring the potential of life history strategies to influence health-related behaviors improves our understanding of why, when and how people engage in health-related choices and decisions. We express the hope that using this perspective (in conjunction with others) may indeed contribute to turning the tide and bend the obesity trend from upward to downward.

5. Author note

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CRediT authorship contribution statement

Bob M. Fennis: Conceptualization, Writing - original draft, Visualization, Writing - review & editing, Methodology, Data curation, Formal analysis. **Justina Gineikiene:** Writing - review & editing, Methodology. **Dovile Barauskaite:** Writing - review & editing, Methodology, Data curation. **Guido M. van Koningsbruggen:** Writing - review & editing, Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Stimulus material for Experiment 2

Scarcity condition:

Abundance condition:

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